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(71) Applicant (*for all designated States except US*): NOKIA TELECOMMUNICATIONS OY [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI).

(72) Inventor; and
(75) Inventor/Applicant (*for US only*): POSTI, Harri [FI/FI]; Rantakatu 14 B 17, FIN-90120 Oulu (FI).

(74) Agent: PATENTTITOIMISTO TEKNOPOLIS KOLSTER OY; c/o Kolster Oy AB, Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).

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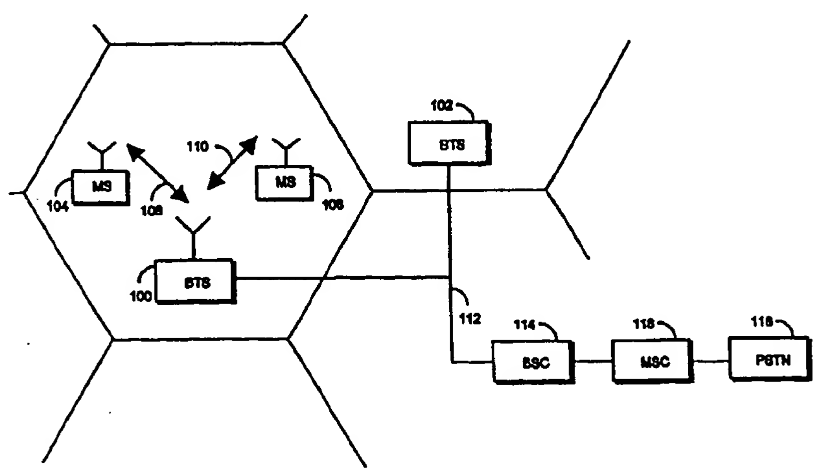

(57) Abstract

The invention relates to a selection of a physical channel in a GSM/DCS-based cellular radio network. More specifically, the invention relates to a selection of a fixed physical control channel and to a selection of a physical traffic channel. The base station (100) comprises a list of physical channels allowed for said base station (100). In the method, interference levels of allowed physical channels are measured and the physical channels to be used for a radio link (108) are selected on the basis of the measured interference level. The base station (100) selects from the allowed physical channels it has measured those channels which have the lowest interference level as fixed physical control channels. Depending on the situation, the subscriber terminal (104) and possibly the base station (100) select the physical traffic channels. A physical channel located at a distance of a fixed frequency spacing from the selected physical traffic channel downlink is selected as a physical traffic channel uplink. Or the frequency spacing between the selected physical traffic channels between downlink and uplink is of random size.

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CHANNEL SELECTION METHOD IN GSM/DCS-BASED CELLULAR RADIO NETWORK

BACKGROUND OF THE INVENTION

The invention relates to the selection of a physical channel in a GSM/DCS-based cellular radio network. More specifically, the invention relates to the selection of a fixed physical control channel and to the selection of a physical traffic channel.

FIELD OF THE INVENTION

The limited amount of radio spectrum available for the development of cellular radio networks is one of the key problems. Attempts are made to minimize the interference caused by a co-channel signal and an adjacent-channel signal by planning the use of radio frequencies carefully. The coverage areas of a base station, i.e. cells, are usually modelled as hexagonal areas. The hexagons are positioned to overlap each other. The frequencies are divided into separate cells in accordance with complicated models of different kinds, the purpose being to minimize the interference occurring in radio connections, which maximizes the network capacity. In this connection, the concept 'frequency reuse factor' turns up. In principle, the lower the reuse factor is, the more efficiently the frequency range is utilized. On the other hand, the same or adjacent frequencies in a reuse pattern of a cell cannot be too close to each other, because too much interference then occurs in the system.

In GSM/DCS-based cellular radio networks, frequency planning is performed manually. The most efficient manner of utilizing the frequency band available to the network operator is then planned. Frequency planning is preliminarily performed at the planning of the network. At commissioning, the results from the frequency planning have to be checked for instance by base station coverage measurements to be performed in the terrain. This is due to the fact that theoretical modelling of the propagation of radio waves is so difficult that fully reliable frequency plans cannot be provided by theoretical calculation and planning only. In particular, reflections caused by different terrain forms and buildings to a radio signal make it difficult to plan the coverage of a cell. Upon commissioning the network, frequency planning and measurements have to be performed for an expansion of the coverage area of the network or for an increase of the capacity of the network.

Though manual network planning and associated measurements are expensive, they have been economically possible up till now, because of the relatively low user penetration of cellular radio networks in densely populated countries and cities.

As the use of mobile phones and other subscriber terminals becomes more common, the capacity of the networks has to be increased continuously. This causes high costs in the form of frequency planning and measurements of different kinds.

For increasing the capacity, microcells and picocells have to be introduced. Frequency planning increases and becomes more difficult than previously. In office buildings especially, a problem will be that building materials of different kinds cause interference to the propagation of radio waves. Novel methods are developed for the frequency planning of such problematic objects. However, extensive measurements are also required in order to secure the working capability of the system. On the other hand, too high frequency reuse factors cause costs in the form of lost capacity.

It may be stated as a conclusion that the present GSM/DCS-based cellular radio networks require careful frequency planning causing rather high costs, to secure the working capability of the system.

BRIEF DESCRIPTION OF THE INVENTION

An object of the present invention is to implement a method by which the above-mentioned problems are avoided.

This is achieved by a method of performing a selection of a physical channel in a GSM/DCS-based cellular radio network, which cellular radio network comprises at least one base station and at least one subscriber terminal connected to the base station by a two-way radio link, the two-way radio link being constituted by at least one fixed physical control channel downlink and at least one fixed physical control channel uplink, and by at least one physical traffic channel downlink and at least one physical traffic channel uplink, and logical channels being positioned on said physical channels, and the base station comprising a list of physical channels allowed for said base station, and in which method interference levels of the allowed physical channels are measured and the physical channels to be used for the radio link are selected on the basis of the measured interference level.

A first method is according to the invention characterized in that the base station selects from the allowed physical channels it has measured those channels which have the lowest interference level as fixed physical control channels.

A second method is according to the invention characterized in that a physical channel located at a distance of a fixed frequency spacing from the selected physical traffic channel downlink is selected as a physical traffic channel uplink.

A third method is according to the invention characterized in that the frequency spacing between the physical traffic channel downlink and the physical traffic channel uplink used for the radio link is of random size.

Another object of the invention is a system for performing a selection of a physical channel in a GSM/DCS-based cellular radio system, which cellular radio network comprises at least one base station and at least one subscriber terminal connected to the base station by a two-way radio link, the two-way radio link being constituted by at least one fixed physical control channel downlink and at least one fixed physical control channel uplink, and by at least one physical traffic channel downlink and at least one physical traffic channel uplink, and logical channels being positioned on said physical channels, and the base station being arranged to maintain a list of physical channels allowed for said base station, and the base station and/or subscriber terminal being arranged to measure interference levels of the allowed physical channels and the base station being arranged to select the physical channels to be used for the radio link on the basis of the measured interference level.

A first system is according to the invention characterized in that the base station is arranged to select from the allowed physical channels it has measured those channels which have the lowest interference level as fixed physical control channels.

A second system is according to the invention characterized in that the base station is arranged to select a physical channel located at a distance of a fixed frequency spacing from the selected physical traffic channel downlink as a physical traffic channel uplink.

A third system is according to the invention characterized in that the frequency spacing between the physical traffic channel downlink and the physical traffic channel uplink to be used for the radio link is of random size.

Many great advantages are achieved by the method of the invention. A very great advantage is that frequency planning is avoided entirely. Another great advantage is achieved by the fact that the network capacity increases by efficient reuse of frequencies accomplished by effective channel selection. The network capacity also increases because a cost-effective introduction of microcells and picocells is possible. The invention enables an implementation of GSM/DCS-based office systems, of which the market has great expectations.

The system of the invention has the same advantages as the method described above. It is obvious that preferred embodiments and detailed embodiments can be joined to combinations of different kinds to provide a desired technical effect.

BRIEF DESCRIPTION OF THE FIGURES

The invention will be described in the following with reference to the examples of the attached drawings, where

Figure 1 shows a cellular radio network,

Figure 2 shows physical channels of a radio link and logical channels to be moved on the physical channels,

Figure 3 is a block diagram illustrating an example of the structure of a base station and a base station controller,

Figure 4 is a block diagram illustrating an example of the structure of a subscriber terminal.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is applicable to all GSM/DCS-based cellular radio networks. GSM/DCS-based cellular radio networks signify a Pan-European GSM system in all different phases of development, i.e. phases 1, 2 and 2+, DCS 1800 and DCS 1900 systems developed on the basis of the GSM system, and various projects for further development of said systems and new projects of development based on those, e.g. a UMTS system under development, if it is even partly based on the GSM system. In this application, the GSM system is used as an example, but the invention is not restricted to that, however.

Figure 1 shows an example of the structure of a cellular radio network according to the invention. Base stations 100, 102 have a hexagonal coverage area, i.e. a cell. The base stations 100, 102 are possibly connected to a base station controller 114 over a connecting line 112. The task of the base station controller 114 is to control the operation of several base stations 100, 102. Normally, there is a connection from the base station controller 114 to a mobile telephone exchange 116, from where there is a further connection to a public switched telephone network 118. In office systems, the operations of the base station 100, the base station controller 114 and even the mobile telephone exchange 116 can be joined in one device, which is then connected to the public switched telephone network 118, for instance to a telephone exchange of the public switched telephone network 118. Subscriber terminals 104, 106 in a cell have a two-way radio link 108, 110 to the base station 100 of the cell. Additionally, the network part, i.e. the fixed part of the cellular radio network, may comprise more base stations, base station controllers, transmission systems and network management systems on different levels. It is obvious to one skilled in the art that a cellular radio network contains many other structures as well, which do not need any further description here.

A two-way radio link 108 is implemented by using physical channels. A physical channel is for instance in GSM one time slot of a 200 kHz frequency band. Figure 2 shows the channels required for the radio link 108 in a simplified manner. The vertical axis illustrates the frequency range of the GSM system, a base station 100 is shown to the left in the figure and a subscriber terminal 104 to the right. A lower frequency band 212 is used uplink, i.e. uplink from the subscriber terminal 104 to the base station 100. In GSM, the lower frequency band 212 comprises a frequency range between 890 and 915 MHz. An upper frequency band 210 is used downlink, i.e. downlink from the base station 100 to the subscriber terminal 104. The network operator disposes of a predetermined part of the frequency bands only, for instance a frequency band of 5 MHz, divided into 200 kHz carriers, each of them normally comprising eight time slots. In this description, time slots are called physical channels. At speech transmission, for instance, two physical channels are normally used as traffic channels: one downlink channel 202 and one uplink channel 206. Upon new standards being completed in 1997 to 1998, several physical channels can be used simultaneously for data transmission or for transmitting moving video picture, for instance.

As appears from Figure 2, a logical Traffic Channel TCH is positioned on the uplink and downlink physical traffic channels 202, 206. The logical traffic channel TCH can be entirely or partly replaced by a Fast Associated Control Channel FACCH relating to the traffic channel, if necessary. Moreover, establishment of a connection and signalling during the connection require separate fixed physical control channels, both a fixed physical control channel 200 downlink and a fixed physical control channel 202 uplink. 'Fixed' refers here to the fact that a fixed control channel is always sent at the same frequency and in the same time slot and that the fixed control channel is not committed to any individual call (as in DECT, for example). The physical control channels downlink are Broadcast Control Channel BCCH, Frequency Correction Channel FCCH, Synchronization Channel SCH, Paging Channel PCH, Access Grant Channel AGCH, Standalone Dedicated Control Channel SDCCH and Slow Associated Control Channel SACCH. The physical control channels uplink are Random Access Channel RACH, Standalone Dedicated Control Channel SDCCH and Slow Associated Control Channel SACCH. Further information on the structure and purpose of these channels is available from the GSM specifications and from the book "An introduction to GSM", S.M. Redl, M.K. Weber, M.W. Oliphant, Artech House, London, 1995, ISBN 0-89006-785-6.

The base station 100 maintains a list of physical channels allowed for it. At commissioning of the network, the base station 100 is provided with a list of the physical channels the base station 100 may use for traffic. Later on, when the network is in use already, the network operator changes the list of the allowed channels by means of a network management system, if he desires to do so, or some network element, for instance a base station controller 114, reorganizes automatically the lists of the frequencies allowed for the base stations 100, 102 managed by it, but yet in such a way that the scope of the frequencies allowed for the part of the network managed by the network or said base station controller 114 is maintained. The list of the allowed physical channels may comprise the whole frequency range allocated to the operator, or alternatively, only part of it. In the first case, the whole network operates dynamically, and consequently, each base station disposes of all physical channels available to the operator, the best ones of which are selected to be used in each particular situation. According to the other alternative, each base sta-

tion has a small part of the operator's whole frequency range at its disposal. The use of frequencies has thereby generally been planned on a rough level.

The base station 100 and/or the subscriber terminal 104 checks the list of the allowed channels and measures the interference level of each physical channel. This measurement is repeated randomly or periodically. The measurer maintains a list of its channels. The list may be implemented in many different ways, for instance such that the channels are divided into different classes, e.g. into channels in use, interference-free and possible channels. Another manner of implementing the list is to arrange the physical channels in order such that the first channel on the list contains little or no interference, and the last channel on the list contains most interference or is in use. The other channels on the list are between these extremities, arranged according to a rising interference level.

The base station 100 and/or the subscriber terminal 104 selects the physical channels to be used for a radio link according to measured interference level. The base station 100 selects from the allowed physical channels it has measured those channels which have the lowest interference level as fixed physical control channels 200, 204. Then the base station 100 sends logical control channels on at least one low-interference physical channel 200 it has selected. Accordingly, the base station 100 uses low-interference physical channels when transmitting for instance control channels important for the establishment of a connection. The quality of the service received by the user improves, because the subscriber terminal 104 is able to establish a connection 108 to the base station 100 more reliably. Correspondingly, the subscriber terminal 104 uses low-interference physical control channels 204 selected by the base station 100. The fixed physical control channels are typically selected at the commissioning of the base station or when the network topology changes.

The base station 100 possibly signals the physical channels it has selected to the base station controller 114. Then the base station controller 114 informs the neighbouring base stations 102 of said base station 100 of which physical channels said base station 100 uses.

The base station 100 may detect training sequences contained in a transmission unit, i.e. a burst, to be used for transmitting a physical channel and select for its use at least one training sequence not used by the neighbouring base stations 102 and signal it to the base station controller 114. A

training sequence is a bit sequence, which is known both by the base station 100 and the subscriber terminal 104 and which helps receivers to be synchronized with a burst received.

At the establishment of a two-way radio link, part of the signalling to be performed normally on separate physical control channels 200, 204 can be moved to be performed on the physical traffic channel 202, 206 already selected. Then the capacity of the SDCCH channel is saved such that, at the establishment of a radio link 108, a handover takes place from the RACH channel directly to the selected traffic channel 202, 206. The signalling needed for the establishment of the link 108 is then performed on the traffic channel 202, 206. No physical SDCCH channel is needed at all, but the FACCH channel relating to the traffic channel 202, 206 of the link is used for signalling. The coverage of the traffic channel 202, 206 can be estimated better than that of the control channels 200, 204, because the link has only two parties on the traffic channel, while several different subscriber terminals 104, 106 may use the same control channels.

The subscriber terminal 104 selects from the allowed physical channels it has measured that channel which has the lowest interference level as the physical channel downlink 202. Accordingly, the subscriber terminal 104 measures interference levels of physical channels at allowed frequencies. In system information, the subscriber terminal 104 has received from the base station 100 an information on which are the allowed channels from among which the subscriber terminal may select its traffic channels. The subscriber terminal 104 maintains a list of its channels. The list is for instance similar to the list described above and maintained by the base station 100.

At the selection of the physical traffic channel uplink 206, there are two alternatives. The physical traffic channel downlink 202 and the physical traffic channel uplink 206 to be used for the radio link 108 may be selected separately, if the frequency spacing between them is of random size. This means that for instance a fixed duplex spacing of 45 MHz used in GSM standard is not necessarily valid, but both the downlink and the uplink traffic channel are selected in such a way that the interference is as low as possible. Either the subscriber terminal 104 or the base station 100 then selects from the allowed physical channels measured by the base station 100 that channel which has the lowest interference level.

If a fixed duplex spacing is used, a physical channel located at a distance of a fixed frequency spacing from the selected physical channel downlink is selected as the physical channel uplink.

A selection of traffic channel 202, 206 comes into question at the establishment of a link 108, but also at a handover. A handover may be an intra-cell handover, i.e. a handover from a physical channel to another one inside a cell, owing to an excessive deterioration of the quality of said channel on account of increased interference, for example. An inter-cell handover is also possible, which means that the link 108 is handed over from one base station 100 to another base station 102.

The subscriber terminal utilizes the system information spread by the base station 100 while selecting a traffic channel 202, 206.. The system information spread by the base station 100 means an information the base station 100 spreads on some logical control channel by a transmission of broadcast type. The system information may vary, depending on the implementation.

The system information contains a list of allowed channels. In this connection, the list of allowed channels is intended for being used by the subscriber terminal 104, 106 in order that the terminal may select its traffic channel 202, 206 in the above manner.

The system information may contain the type of each neighbouring base station 102. The subscriber terminal 104 being informed of the type of the neighbouring base stations 102, for instance GSM phase 1, GSM/DCS phase 2, DS (= Dynamic Selection), helps the subscriber terminal 104 to plan its operation. While performing a possible handover to said neighbouring base station 102, the subscriber terminal 104 knows whether the procedures described in this invention are used there. This makes it possible to build networks comprising both base stations according to the prior art and base stations described in this invention mixed together.

The system information may contain a list of channels allowed for each neighbouring base station 102. On said channels, the subscriber terminal 104 performs measurements of the radio field it has received and possibly also interference measurements, being thus prepared for a possible handover. The system information may contain the identification data of the physical channel including the BCCH channel of each neighbouring base station, for instance the frequency and also the time slot in case of synchronic cellular ra-

dio network. Now, the subscriber terminal 104 does not need to measure all the channels disposed by the neighbouring base station 102, but the subscriber terminal 104 measures the radio field it has received only on physical channels including the BCCH channel.

The system information may contain information on the interference levels of the physical traffic channels uplink. In this way, the subscriber terminal 104 finds out how the coverages of said channels are towards the base station 100; the subscriber terminal 104 utilizes this information when selecting its traffic channels in the above manner.

The system information may contain a list of allocated physical channels. The subscriber terminal 104 is thus informed of which channels are allocated already. No interference measurements of these channels are necessary any longer, but the subscriber terminal 104 marks them as allocated.

The system information may contain a quality threshold for channel selection. Quality threshold for channel selection signifies that limit of the interference level below which a channel is at disposal and above which a channel includes too much interference for a reliable traffic.

The system information may contain a quality threshold for an intra-cell handover. This threshold signifies that limit of the interference level of a radio link above which the subscriber terminal 104 requests the base station 100 to move over to another channel having a better coverage. The system information may also contain a margin for an inter-cell handover.

When the subscriber terminal 104 is active and uses discontinuous transmission, it 104 may perform measurements of the neighbouring base stations 102 during a break in its transmission, in order to discover the need of a possible inter-cell handover.

At frequency hopping, the subscriber terminal 104 selects the physical channels to be used for a frequency hopping sequence. In this way, the method of the invention also functions in a GSM/DCS-based cellular radio network using frequency hopping.

When the subscriber terminal 104 selects the traffic channels, it may request the base station for an acceptance of the physical traffic channel it has proposed. The subscriber terminal 104 then signals on the RACH channel to the base station 100 the identification data of the at least one physical channel it has selected, i.e. it signals which at least one selected physical channel with low interference level it wishes to use as a traffic channel. This

may take place at the establishment of a connection, both when a mobile-originated call and a mobile-terminated call are concerned. This may also take place during a call, whereby the signalling associated with a hand-over is performed on the FACCH channel relating to an old traffic channel. The base station 100 signals on an AGCH channel, whether it accepts the at least one traffic channel proposed by the subscriber terminal 104. In the manner described previously, the subscriber terminal 104 may move to start trafficking on the proposed at least one traffic channel immediately after the subscriber terminal 104 has received an acceptance of the proposed at least one traffic channel from the base station. The signalling associated with the establishment of a connection is then performed on the traffic channel. It is also possible that the signalling associated with the establishment of a connection is performed in a normal manner described in GSM standard, and not until then, the use of the proposed traffic channel begins.

When the base station 100 rejects the traffic channel proposed by the subscriber terminal 104, the subscriber terminal 104 proposes some other at least one traffic channel. The base station 100 may reject the traffic channel proposed by the subscriber terminal 104, if the quality of said channel is not good enough for trafficking from the viewpoint of the base station. The base station 100 may reject the traffic channel proposed by the subscriber terminal 104 only a predetermined number of times. However, because the base station has more processing capacity for postprocessing of a signal and better antennas, the channel selection is optimized for the subscriber terminal 104 in disadvantageous conditions. The channel selection can also be considered unsuccessful, in which case it has to be performed once more.

Let us examine Figure 3 showing the structure of a base station 100 and a base station controller 114 in more detail. A base station controller 114 is connected to the base station 100. The base station controller 114 is connected to a mobile telephone exchange 116. The base station controller 114, the base station 100 and the mobile telephone exchange 116 generally are separate devices. In addition, systems are known in which the operations of the base station 100 and the base station controller 114 are joined in a single device. Operations of the mobile telephone exchange 116 can also be joined in that single device.

Tasks of a mobile telephone exchange 116 are for instance: implementation of a switching network, control of establishment and release of connections, collecting invoicing data and control of echo cancelling devices.

The base station controller 114 monitors and controls a number of base stations 100. There is typically one base station controller 114 for some dozens or hundreds of base stations 100. A base station controller 114 comprises a group switching network 302, a transcoder 304 and a control unit 306. The group switching network 302 is used for switching speech and data and for connecting signalling circuits. The transcoder 304 converts different digital speech coding modes to be used between the public telephone network and the mobile telephone network to make them compatible with each other. The control unit 306 performs call control, mobility management, collecting statistical data and signalling.

The base station 100 typically comprises one to sixteen transceivers, each one of them representing eight physical channels in GSM The base station 100 comprises a frame unit 312, a frequency-hopping unit 314, a carrier unit 316, an antenna 318 and a control and maintenance unit 324. Downlink in the frame unit 312, channel coding, channel interleaving, data encryption and burst formation are performed. Uplink in the frame unit 312, digital demodulation, data decryption, channel de-interleaving and channel decoding are performed. In the frequency-hopping unit 314, frequency hopping of a baseband wave is performed. The carrier unit 316 comprises a transceiver 320 and a receiver 322. A modulation (for instance GMSK modulation) and power amplification of a signal to be transmitted are performed in the transmitter 320 of the carrier unit 316. An A/D conversion and Received Signal Strength Indication (RSSI) measurements of a received signal are performed in the receiver 322 of the carrier unit 316. The control and maintenance unit 324 controls and monitors the operation of the other units of the base station 310. The base station 100 generally comprises several frame units 312 and corresponding carrier units 316.

The base station 100 is arranged to maintain a list of allowed physical channels. In addition, the base station 100 is arranged to measure the interference levels of the allowed physical channels. The base station 100 is also arranged to select the physical channels to be used for a radio link on the basis of the measured interference level.

The simplest way of implementing the invention is to convert the steps of the method of the invention to be performed as a software. Then the software can be positioned for instance in the memory of a processor included in the control and maintenance part 324 of the base station 100. The control part 324 then controls the receiver 320 to measure interference levels of channels and controls the frame unit 312 and the transmitter 322 in order that the logical control channels may be sent on some physical channel. On the other hand, the application may also be implemented by ASIC circuits or by a separate logic constituted by separate HW parts.

Let us examine Figure 4 showing the structure of a possible subscriber terminal 104 in a simplified manner. The subscriber terminal 104 comprises a user part 400, a radio part 420, a control unit 450 and an antenna 470. The task of the user part 400 is to operate as a user interface of the subscriber terminal 104. The task of the radio part 420 is to convert a signal to be transmitted compatible with the radio link 108, and respectively, to convert a received signal to be understood by the user. The tasks of the antenna 470 are to receive a signal from the radio link 108 and to send a signal to the radio link 108. The user part 400 comprises a loudspeaker 402, a display 404, a keyboard 406 and a microphone 408. The radio part 420 comprises a receiver 430, a transmitter 440, a control unit 450 and a duplex filter 460. The receiver 430 comprises a demodulator 432, a decryptor 434, a channel decoder 436 and a source decoder 438. The transmitter comprises a source coder 442, a cryptor 444, a channel coder 446 and a modulator 448.

A signal is received by the antenna 470, from which it is brought via the duplex filter 460 to the receiver 430. Initially, the signal is demodulated in the demodulator 432. Then the encryption is decrypted by the decryptor 434. Subsequently, the signal is decoded in the channel decoder 436. Finally, the received information is converted to a presentable form by the source decoder 438, then the speech information is brought to the loudspeaker 402 and the signalling sent from the base station 100 is processed in the control unit 450. When the information to be sent comes from the microphone 408 and the control unit 450 to the transmitter 440, the speech information is digitized, and subsequently, code words are created in the source coder 442 from the digitized speech information and signalling. Then the information to be sent is coded in the channel coder 444, after which an encryption takes place in the cryptor 446. The information is then modulated in the modulator 448. Finally,

the information to be sent is brought via the duplex filter 460 to the antenna 470. It is essential for the invention that the control unit 450 controls the units to which it is connected in the figure.

The subscriber terminals 104 of a cellular radio network according to the invention comprise modifications of normal structures as follows: the subscriber terminal 104 is arranged to measure the interference levels of the allowed physical channels. The measurement is performed according to prior art technique in such a way that the control unit 450 controls the receiver 430 to change its frequency and to measure the interference level of each allowed channel. Further, the subscriber terminal 104 is arranged to select the physical channels to be used for a radio link on the basis of the measured interference level.

For the simplest implementation of the invention, the control unit 450 requires a software, which, besides the normal operations, is capable of interpreting modulated signalling received from the base station 410, capable of transmitting signalling and capable of performing measurements of interference level as described above. The above operations can also be implemented for instance by ASIC circuits or by a separate logic constituted by HW parts.

Though the invention has above been described with reference to an example according to the attached drawings, it is obvious that the invention is not restricted to that, but it can be modified in many ways within the scope of the inventive idea set forth in the attached claims.

CLAIMS

1. A method of selecting a physical channel in a GSM/DCS-based cellular radio network, which cellular radio network comprises at least one base station (100) and at least one subscriber terminal (104) connected to the base station (100) by a two-way radio link (108), the two-way radio link (108) being constituted by at least one fixed physical control channel downlink and at least one fixed physical control channel uplink, and by at least one physical traffic channel downlink and at least one physical traffic channel uplink, and logical channels being positioned on said physical channels, and the base station (100) comprising a list of physical channels allowed for said base station (100), and in which method interference levels of the allowed physical channels are measured and the physical channels to be used for the radio link (108) are selected on the basis of the measured interference level, **characterized** in that the base station (100) selects from the allowed physical channels it has measured those channels which have the lowest interference level as fixed physical control channels.

2. A method according to claim 1, **characterized** in that the fixed physical control channel is selected at commissioning of the base station (100), or when the topology of the network changes.

3. A method according to claim 1, **characterized** in that the list of allowed physical channels comprises the entire frequency range allocated to the operator.

4. A method according to claim 1, **characterized** in that the list of allowed physical channels comprises part of the frequency range allocated to the operator.

5. A method according to claim 1, **characterized** in that the base station (100) detects training sequences and selects for its use at least one training sequence not used by neighbouring base stations (102) and signals it to a base station controller (114).

6. A method of selecting a physical channel in a GSM/DCS-based cellular radio network, which cellular radio network comprises at least one base station (100) and at least one subscriber terminal (104) connected to the base station (100) by a two-way radio link (108), the two-way radio link (108) being constituted by at least one fixed physical control channel downlink and at least one fixed physical control channel uplink, and by at least one physical

traffic channel downlink and at least one physical traffic channel uplink, and logical channels being positioned on said physical channels, and the base station (100) comprising a list of physical channels allowed for said base station (100), and in which method interference levels of the allowed physical channels are measured and the physical channels to be used for the radio link (108) are selected on the basis of the measured interference level, **characterized** in that a physical channel located at a distance of a fixed frequency spacing from the selected physical traffic channel downlink is selected as a physical traffic channel uplink.

7. A method of selecting a physical channel in a GSM/DCS-based cellular radio network, which cellular radio network comprises at least one base station (100) and at least one subscriber terminal (104) connected to the base station (100) by a two-way radio link (108), the two-way radio link (108) being constituted by at least one fixed physical control channel downlink and at least one fixed physical control channel uplink, and by at least one physical traffic channel downlink and at least one physical traffic channel uplink, and logical channels being positioned on said physical channels, and the base station (100) comprising a list of physical channels allowed for said base station (100), and in which method interference levels of the allowed physical channels are measured and the physical channels to be used for the radio link (108) are selected on the basis of the measured interference level, **characterized** in that the frequency spacing between the physical traffic channel downlink and the physical traffic channel uplink used for the radio link is of random size.

8. A method according to claim 6 or 7, **characterized** in that the selection of the physical traffic channel is made at the establishment of a call.

9. A method according to claim 6 or 7, **characterized** in that the selection of the physical traffic channel is made at an intra-cell handover.

10. A method according to claim 6 or 7, **characterized** in that the selection of the physical traffic channel is made at an inter-cell handover.

11. A method according to claim 6 or 7, **characterized** in that system information spread by the base station (100) is utilized for the selection.

12. A method according to claim 11, **c h a r a c t e r i z e d** in that the system information comprises a list of allowed channels.

13. A method according to claim 11, **c h a r a c t e r i z e d** in that the system information comprises the type of each neighbouring base station (102).

14. A method according to claim 11, **c h a r a c t e r i z e d** in that the system information comprises a list of channels allowed for each neighbouring base station (102).

15. A method according to claim 11, **c h a r a c t e r i z e d** in that the system information comprises information on interference levels of the physical channels uplink.

16. A method according to claim 11, **c h a r a c t e r i z e d** in that the system information comprises a list of allocated physical channels.

17. A method according to claim 11, **c h a r a c t e r i z e d** in that the system information comprises a quality threshold for channel selection.

18. A method according to claim 11, **c h a r a c t e r i z e d** in that the system information comprises a quality threshold for an intra-cell handover.

19. A method according to claim 11, **c h a r a c t e r i z e d** in that the system information comprises a quality threshold for an inter-cell handover.

20. A method according to claim 6 or 7, **c h a r a c t e r i z e d** in that when the subscriber terminal (104) is active and uses discontinuous transmission, the subscriber terminal (104) performs measurements of neighbouring base stations (102) during a break in its transmission, the purpose being to discover the need of a possible inter-cell handover.

21. A method according to claim 6 or 7, **c h a r a c t e r i z e d** in that when frequency hopping is used, the subscriber terminal (104) selects the physical channels to be used in a frequency hopping sequence.

22. A method according to claim 6 or 7, **c h a r a c t e r i z e d** in that the subscriber terminal (104) requests the base station (100) for an acceptance of the physical traffic channel it has proposed.

23. A method according to claim 22, **c h a r a c t e r i z e d** in that the subscriber terminal (104) signals identification data of the at least one physical channel it has selected on the RACH channel to the base station (100) and the base station (100) signals on the AGCH channel whether it ac-

cepts the at least one traffic channel proposed by the subscriber terminal (104).

24. A method according to claim 23, **characterized** in that upon the base station (100) rejecting the traffic channel proposed by the subsccriber terminal (104), the subscriber terminal (104) proposes another at least one traffic channel.

25. A method according to claim 24, **characterized** in that the base station (100) may reject the traffic channel proposed by the subscriber terminal (104) only a predetermined number of times.

26. A system for performing a selection of a physical channel in a GSM/DCS-based cellular radio system, which cellular radio network comprises at least one base station (100) and at least one subscriber terminal (104) connected to the base station (100) by a two-way radio link (108), the two-way radio link (108) being constituted by at least one fixed physical control channel downlink and at least one fixed physical control channel uplink, and by at least one physical traffic channel downlink and at least one physical traffic channel uplink, and logical channels being positioned on said physical channels, and the base station (100) being arranged to maintain a list of physical channels allowed for said base station (100), and the base station (100) and/or subscriber terminal (104) being arranged to measure interference levels of the allowed physical channels and the base station (100) being arranged to select the physical channels to be used for the radio link (108) on the basis of the measured interference level, **characterized** in that base station (100) is arranged to select from the allowed physical channels it has measured those channels which have the lowest interference level as fixed physical control channels.

27. A system for selecting a physical channel in a GSM/DCS-based cellular radio system, which cellular radio network comprises at least one base station (100) and at least one subscriber terminal (104) connected to the base station (100) by a two-way radio link (108), the two-way radio link (108) being constituted by at least one fixed physical control channel downlink and at least one fixed physical control channel uplink, and by at least one physical traffic channel downlink and at least one physical traffic channel uplink, and logical channels being positioned on said physical channels, and the base station (100) being arranged to maintain a list of physical channels allowed for said base station (100), and the base station (100) and/or subscriber terminal (104)

being arranged to measure the interference levels of the allowed physical channels and the base station (100) being arranged to select the physical channels to be used for the radio link (108) on the basis of the measured interference level, **c h a r a c t e r i z e d** in that the base station (100) is arranged to select a physical channel located at a distance of a fixed frequency spacing from the selected physical traffic channel downlink as a physical traffic channel uplink.

28. A system for selecting a physical channel in a GSM/DCS-based cellular radio system, which cellular radio network comprises at least one base station (100) and at least one subscriber terminal (104) connected to the base station (100) by a two-way radio link (108), the two-way radio link (108) being constituted by at least one fixed physical control channel downlink and at least one fixed physical control channel uplink, and by at least one physical traffic channel downlink and at least one physical traffic channel uplink, and logical channels being positioned on said physical channels, and the base station (100) being arranged to maintain a list of physical channels allowed for said base station (100), and the base station (100) and/or subscriber terminal (104) being arranged to measure the interference levels of the allowed physical channels and the base station (100) being arranged to select the physical channels to be used for the radio link (108) on the basis of the measured interference level, **c h a r a c t e r i z e d** in that the frequency spacing between the physical traffic channel downlink and the physical traffic channel uplink to be used for the radio link (108) is of random size.

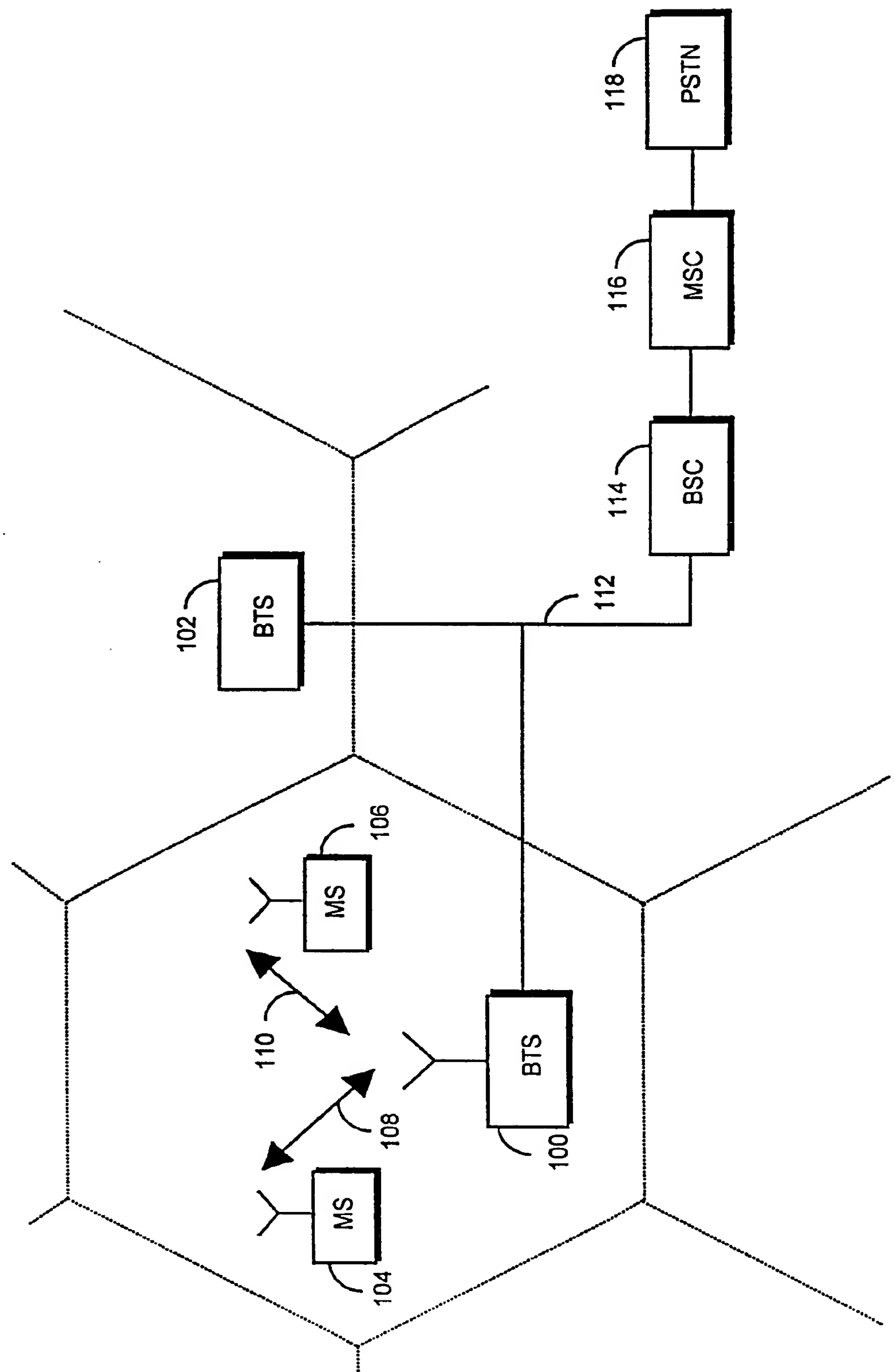
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Fig 1

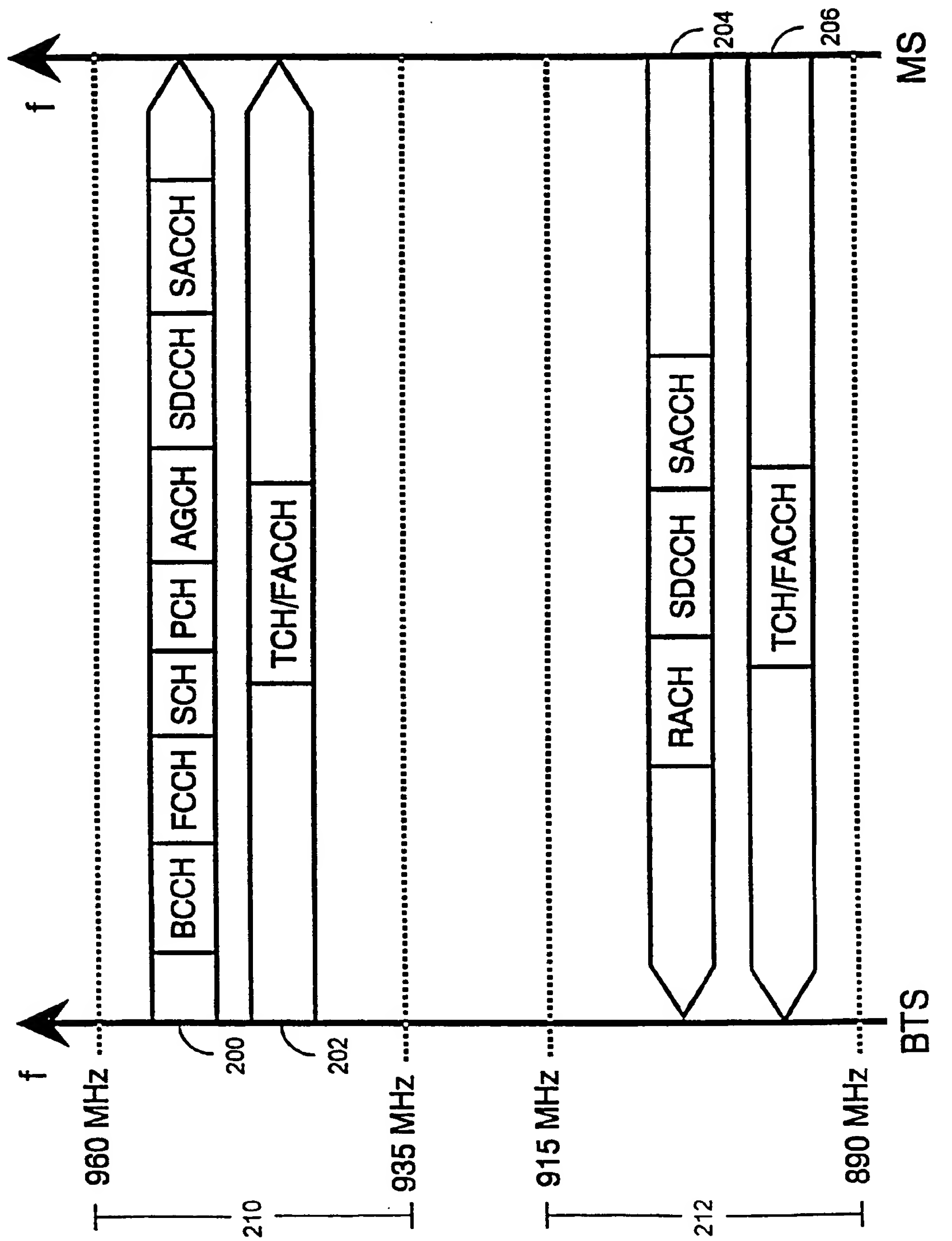
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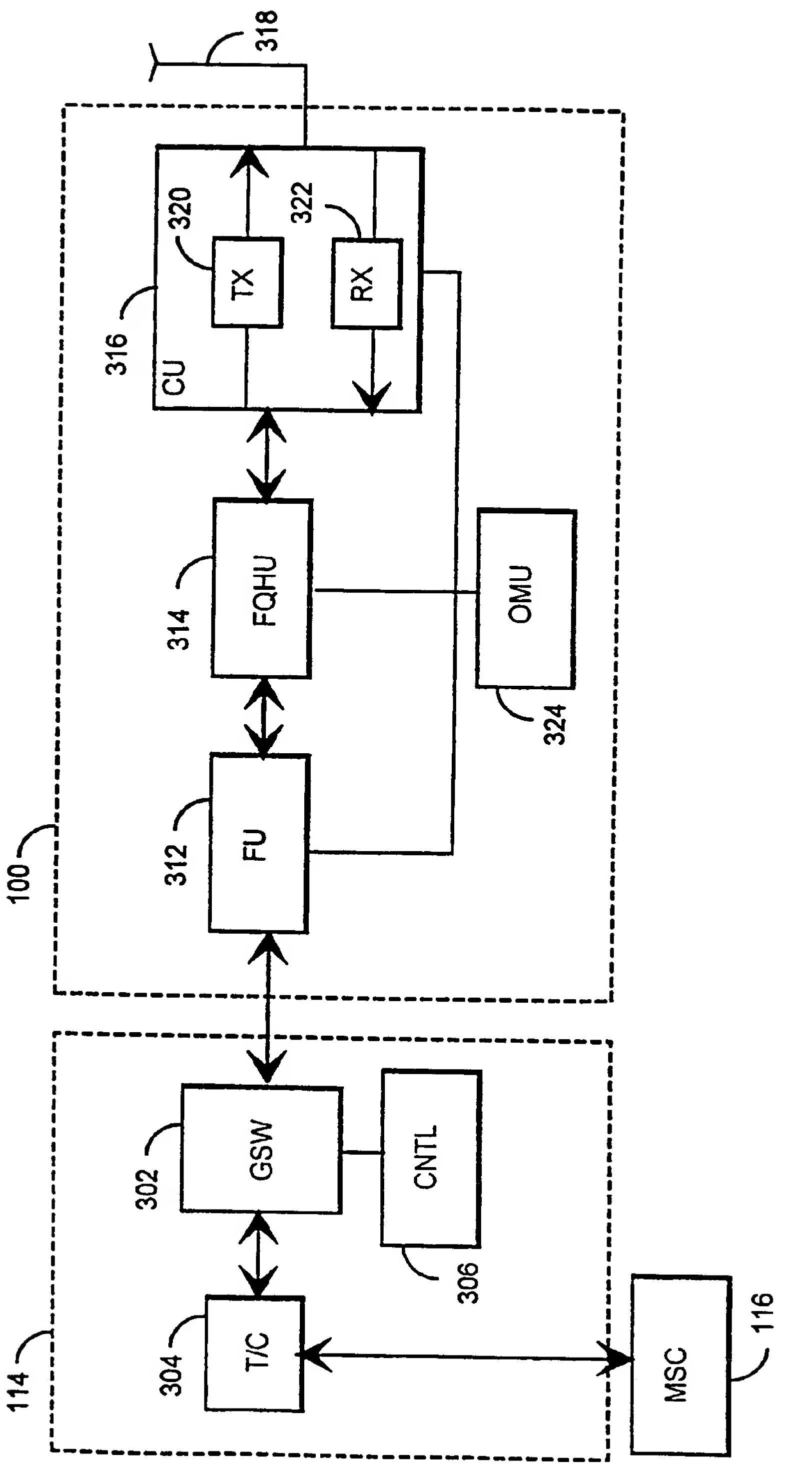
Fig 2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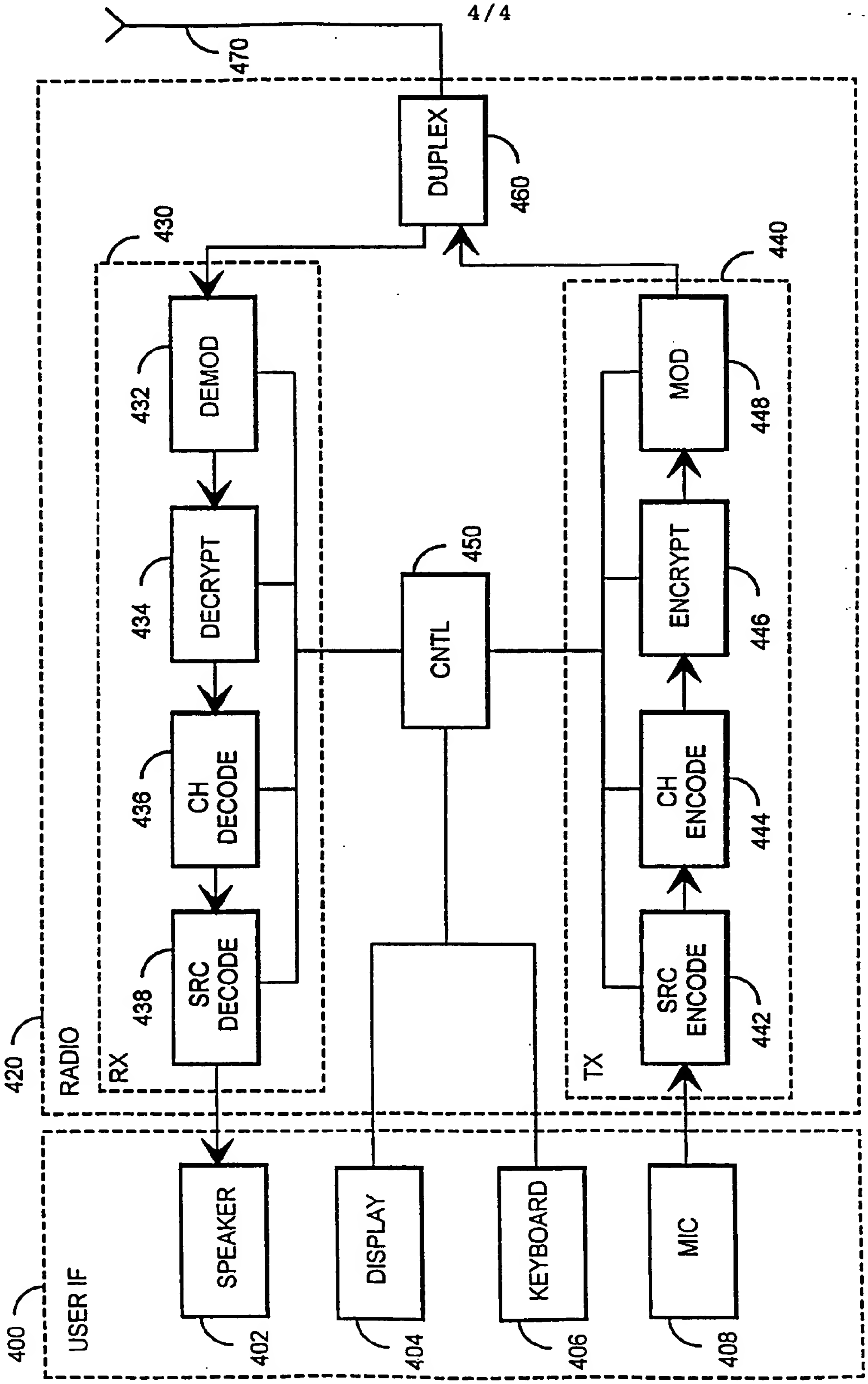
MSC
116

Fig 3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MOD
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ENCRYPT
446
CH ENCODE
444
SRC ENCODE
442
USER IF
400
SPEAKER
402
DISPLAY
404
KEYBOARD
406
MIC
408

Fig 4